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## Short communication

## Natural orifice transvaginal endoscopic surgery for endometrial cancer

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## ABSTRACT

**Objective:** This study was conducted to describe the feasibility of treating endometrial cancer with hysterectomy, bilateral salpingo-oophorectomy, and bilateral pelvic lymphadenectomy by natural orifice transluminal endoscopic surgery (NOTES).**Methods:** Women with early-stage endometrial cancer underwent surgical staging by transvaginal NOTES in a tertiary referral medical center, and surgical outcomes were measured.**Results:** Three patients with a mean age of 46.3 [standard deviation (SD) = 2.5] years and a body mass index of 27.7 (SD, 2.4) kg/m<sup>2</sup> were selected. The average operative time was 249.3 (SD, 49.3) minutes. All patients had minimal blood loss during the operation (<50 mL) without intraoperative blood transfusion. All of them had a surgical staging of pT1aN0M0 and FIGO IA. No intraoperative or postoperative complications were noted. No cases were converted to traditional laparoscopy or laparotomy.**Conclusion:** NOTES is a minimally invasive surgery and leaves only invisible scars. Our preliminary results showed the safety and feasibility of transvaginal NOTES in staging surgery for early-stage endometrial cancer. However, it should be evaluated in more cases.

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## Introduction

This is the first study on natural orifice transvaginal endoscopic surgery (NOTES) in surgical staging for endometrial cancer. The incidence of endometrial cancer has increased rapidly and is one of the most common gynecologic malignancies in Taiwan. It affected approximately 250 women in 1995, 418 women in 2000, and approximately 1100 in 2007.<sup>1</sup> In the United States, it is estimated that there are 42,100 new cases annually and 7400 deaths resulting from this disease.

Recently, gynecologic oncologists have increasingly used minimally invasive techniques to treat gynecologic cancers.<sup>2–7,13</sup> Childers et al first demonstrated that laparoscopic-assisted surgical staging of endometrial cancer was feasible.<sup>8</sup> Since then, this approach has been used increasingly and revealed that laparoscopic-assisted surgical staging has better surgical outcomes

as well as a 5-year survival rate.<sup>9</sup> New minimally invasive surgery techniques have recently been developed for better surgical outcomes and cosmesis, and NOTES is one of them.

We established a new method of transvaginal NOTES to perform hysterectomy<sup>10–12</sup> and have now extended NOTES to gynecologic oncology procedures. In this paper, we report our preliminary data on early endometrial cancer for laparoscopic staging surgery via the NOTES approach.

## Materials and methods

Three patients with early-stage endometrial cancer who were eligible for laparoscopic staging surgery, including laparoscopic hysterectomy, bilateral salpingo-oophorectomy, and bilateral pelvic lymph nodes dissection, were recruited to undergo NOTES in Chang Gung Memorial Hospital at Linkou, Taiwan.

These three patients were operated on at the age of 44 years, 56 years, and 59 years, respectively. The last two patients presented with postmenopausal vaginal bleeding for months, and both denied hormone replacement therapy history. The youngest one, who had regular menstrual cycles, was incidentally found to have endometrial lesions via transvaginal sonography. In these three

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cases, endometrial cancer was suspected (by office hysteroscopy), and then proven by endometrial biopsy.

In the tumor marker survey prior to the operation, only the youngest patient had a mild elevated carbohydrate antigen 19-9 (CA19-9), at 41.5 U/mL. The other patients' tumor markers including carbohydrate antigen 125 (CA-125), CA19-9, and carcinoembryonic antigen were all within normal ranges prior to the operation. Based on the hysteroscopic endometrial biopsy, the pathology reports of specimens indicated atypical complex hyperplasia with focal well-differentiated endometrioid adenocarcinoma in two patients, and well-differentiated endometrioid adenocarcinoma with prominent mucinous differentiation in one patient. Computed tomography or magnetic resonance imaging revealed endometrial cancer without nodal or distant metastases. Their clinical stages were cT1aN0M0 and FIGO IA. Under the suspicion of having early-stage endometrial cancer, the patients underwent surgical staging via the transvaginal NOTES approach.

All patients undergoing surgical management gave their written informed consent. All surgeries were performed by experienced gynecologic endoscopists.

### *Surgical techniques*

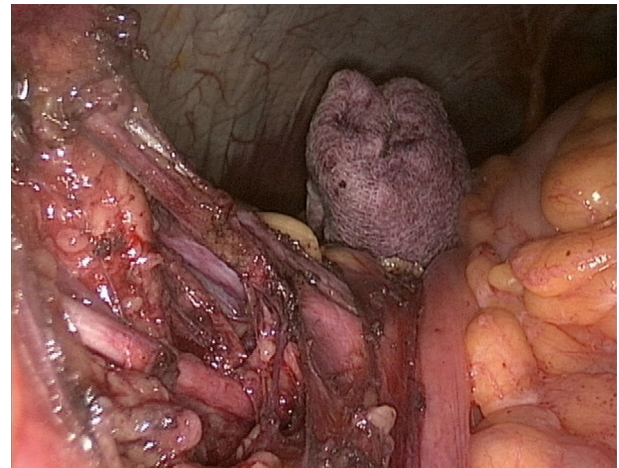
Under general anesthesia with endotracheal intubation, patients were placed in the Trendelenburg position with their legs bandaged and supported in the stirrups. A 12F Foley catheter was indwelled.

### *Anterior and posterior colpotomy*

With tractions on the uterine cervix using two teneculums, the operation began with a circumcision of the vaginal mucosa around the cervix. Then, anterior and posterior colpotomy were performed. The transverse cervical and the uterosacral ligament complex were well exposed and then clamped and divided using the bipolar vessel sealer (LigaSure Impact System; Covidien Company, Boulder, CO, USA).

### *Establishing the vaginal channel for endoscopic surgery*

A small LagiPort Kit multiple instrument access port (Lagis Enterprise Co. Ltd., Taichung, Taiwan) was inserted into the vagina and around the cervix (Fig. 1A and B), with its inner rim fixed against the anterior and posterior cul-de-sac, then two 10-mm cannulas and one 5-mm cannula were inserted. The endoscope used was a 10-mm, 0° endoscope (Karl Storz GmbH & Co. KG, Tuttlingen, Germany), and the energy source was a 5-mm bipolar LigaSure system (Covidien Company) designed for laparoscopy.



**Fig. 2.** Right external iliac vessels and right pelvic lymph node dissection.

### *Endoscopic management of the uterus*

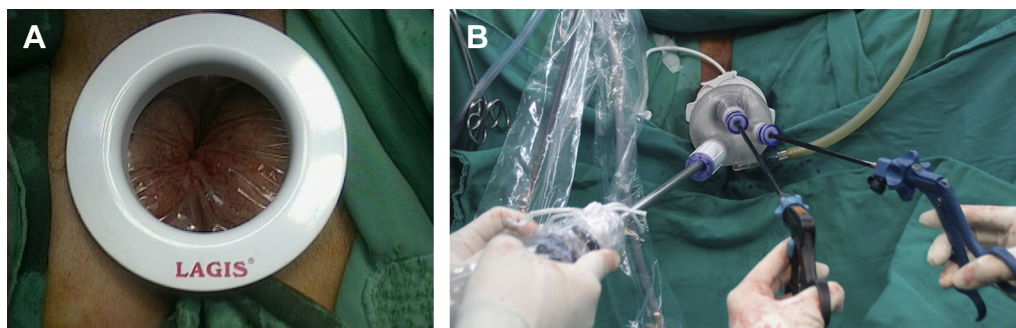
After adequate pneumoperitoneum and insertion of the endoscope to explore the pelvis, the peritoneal cavity was checked first for any tumor seeding. Then, the bilateral broad ligaments with uterine vessels were identified and secured using the bipolar vessel sealer. The remaining broad ligaments and round ligaments were secured and divided using the LigaSure bipolar forceps step by step. Bilateral infundibulopelvic ligaments were then clamped, secured, and divided. After clearing of all pedicles, the uterus was removed through the vagina. The LagiPort was then reinserted for further procedures.

### *Endoscopic management of the bilateral pelvic lymph nodes*

After the ureter had been clearly identified, a scissor was used to open the peritoneum at the level of 1 cm above the ureter and the spaces of the paravesicle area and pararectal area were created. It is easy to identify the internal and external iliac vessels after skeletalization. The external iliac artery was free from the inguinal area to the bifurcation of the common iliac artery. This allowed the adiposolymphatic tissue around external iliac vessels, obturator nerve, and hypogastric vessels to be removed (Figs. 2 and 3).

### *Completing the procedures*

After hemostasis was achieved, the vaginal cuff was closed with a 2–0 Vicryl suture, and the operation was completed after a routine diagnostic cystoscopic checkup.



**Fig. 1.** (A, B) Insertion of LagiPort.

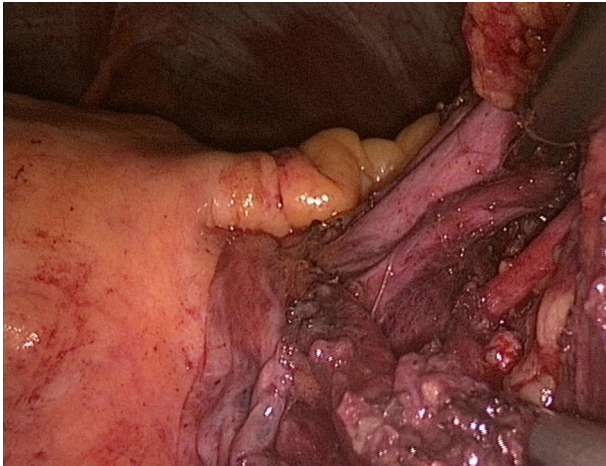


Fig. 3. Left external iliac vessels and left pelvic lymph node dissection.

Prophylactic antibiotics with preoperative cefazolin, and postoperative cefazolin and gentamicin for 1 day were given. Nonsteroidal anti-inflammatory drugs were also routinely prescribed after the operation, and 30 mg nalbuphine was given intramuscularly as needed. The Foley catheter was removed in the morning of the day after the operation. Patients were discharged, according to national regulations, with an afebrile status for at least 24 hours and no evidence of surgical complications.

## Results

These three patients, who had a mean age of 46.3 [standard deviation (SD), 2.5] years and a body mass index of 27.7 (SD, 2.4) kg/m<sup>2</sup>, underwent laparoscopic hysterectomy, bilateral salpingo-oophorectomy, and bilateral pelvic lymph nodes dissection via the transvaginal NOTES approach for endometrial cancer staging and treatment. All three patients were multiparous (median, 2; range, 2 or 3). Only one of them had a cesarean section twice, and the others had vaginal deliveries. All of them denied having hypertension, diabetes mellitus, heart diseases, or a history of other abdominal surgical procedures. Their demographic data and intraoperative and postoperative surgical outcomes are detailed in Table 1. Their mean operative time was 249.3 (SD, 49.3) minutes. All patients had minimal blood loss during the operation, and none of

them required intraoperative blood transfusion. In the laboratory data survey on the 1<sup>st</sup> postoperative day, their mean hemoglobin decreased 1.5 (SD, 0.2) g/dL on average. The median postoperative hospital stay was 5 (range, 4 or 5) days.

The pathology results and surgical stage are shown in Table 2. The three patients were all cT1aN0M0 preoperatively. The final histology results showed that they all had endometrioid adenocarcinoma, of which two were well differentiated and one was moderately differentiated. One patient had no myometrial involvement, and the other two had myometrial invasion of less than 5% and 10%, respectively. The average lymph node yield was 9. The cervix, bilateral adnexa, and bilateral pelvic lymph nodes were negative for malignancy. All patients were surgical stage pT1aN0M0 and FIGO IA.

## Discussion

To our knowledge, our study is the first report about NOTES in staging surgery for endometrial cancer. NOTES is a new surgical concept and a type of modified single-port laparoscopy. Compared to traditional multiport laparoscopy, NOTES has no port insertion in the abdomen; this avoids disruption of the muscle and fascia of the abdomen and prevents possible complications of trocar insertion. For these reasons, NOTES achieves cosmesis and leaves only invisible scars. On the basis of our previous experience with NOTES surgery for adnexal tumor and hysterectomy,<sup>9–12</sup> we applied NOTES in staging surgery for early-stage endometrial cancer.

In NOTES staging surgery, the feeding vessels of the uterus are sealed prior to any manipulation so that intraoperative blood loss will decrease. Therefore, the superiority of transvaginal NOTES for hysterectomy is significant. However, there are several disadvantages in NOTES staging surgery, including restricted surgical field, poor visualization, and difficult approach in patients with a narrow vagina, large uteri, or adhesions. However, the disadvantages can be rectified by using our method. Surgeons can perform hysterectomy and lymph nodes dissection transvaginally under direct and magnified vision similar to their experience in laparoscopic surgery.

The identification of paravesical and pararectal spaces and skeletalization of vessels in NOTES staging surgery are complicated processes because the spaces were created from the buttocks of the patients. In our method, we identified the ureter first and used a scissor to open the peritoneum 1 cm above the ureter, then pushed the ureter downward. This method prevented ureteral injury and

Table 1  
The patients' characteristics and surgical outcomes.

Case no.	Age (y)	Parity	C/S	BMI (kg/m <sup>2</sup> )	Other abdominal surgery	Pathology of endometrial biopsy	Operative time (min)	Blood loss (mL)	Hb change (g/dL)	BT	Postoperative stay (d)
1	44	2	0	27.0	Nil	Endometrioid adenocarcinoma, Grade 1	206	50	−1.6	No	5
2	56	2	2	30.3	Nil	Endometrioid adenocarcinoma, Grade 1	303	30	−1.3	No	4
3	59	3	0	25.7	Nil	Endometrioid adenocarcinoma, Grade 1	239	30	−1.7	No	5

BMI = body mass index; BT = blood transfusion; C/S = cesarean section; Hb = hemoglobin.

Table 2  
Pathology.

Case no.	Preoperative stage	Histology	Cervical invasion	Myometrial invasion	Adnexa	Right pelvic LNs (number)	Left pelvic LNs (number)	Surgical staging
1	Grade1, cT1aN0M0	Endometrioid adenocarcinoma with focal squamous differentiation, grade I	No	<1 cm, (<5 %)	N	N (3)	N (2)	T1aN0M0, FIGO IA
2	Grade1, cT1aN0M0	Endometrioid adenocarcinoma, grade II	No	0.3 cm, (10 %)	N	N (3)	N (4)	T1aN0M0, FIGO IA
3	Grade1, cT1aN0M0	Endometrioid adenocarcinoma with mucinous differentiation, grade I	No	No	N	N (7)	N (10)	T1aN0M0, FIGO IA

Hb = hemoglobin; LN = lymph node; N = negative for malignancy.



helped us to easily identify the internal and external iliac vessels after opening the spaces.

In conclusion, NOTES staging surgery is a new, safe, and feasible minimally invasive surgery for endometrial cancer. It not only overcomes the limitations but also broadens the indications of NOTES surgery to oncologic surgery. However, a large case series or even prospectively randomized controlled trials should be conducted to evaluate the true clinical feasibility, safety, and most importantly, the long-term survival outcomes of this approach.

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